

Name \_\_\_\_\_  
Chem 226/ Fall 2004

Section \_\_\_\_\_  
Dr. Rusay

***Organic Chemistry: Toxicity, Health & Safety***



Working with organic chemicals can pose certain risks. Many compounds are flammable. Many produce physiological effects. Sometimes these effects are not always known nor immediately obvious. Therefore, all chemicals should be treated as being potentially hazardous. However, governments throughout the world require that known hazard and safety information be published for public inspection and comment. In the U.S. and Europe, manufacturers are required by law to provide this information in a document called an **MSDS**, a Material Safety Data Sheet, which provides a compound's physical properties, health risks, chemical reactivity, flammability, and procedures for storage, handling, and disposal.

In Chem 226, before undertaking any lab experimentation, you will become familiar with these documents and other resources that provide Health & Safety information for organic molecules. Read: the Lab text, *Lehman* pp. 14-18. You should be particularly aware of the relevance of the numerical classifications for Health, Flammability, Contact, and Reactivity.

This assignment has 2 parts: **Part I** is an individual assignment. Turn in this page (If not enough room attach a second page.) with definitions for the following terms using references found on the *World Wide Web*, or the *DVC Library* or the *Merck Index* that can be checked out of the DVC stockroom. You are highly encouraged to use the Web links that are included in the Chem 226 Web Resource collection at:

***<http://ep.llnl.gov/msds/orgchem/Chem226/226web-04.html>***

***Part I: Definitions***

- 1) Acute Toxicity
- 2) LD<sub>50</sub>
- 3) Exposure
- 4) PEL
- 5) Carcinogenicity
- 6) Chronic Toxicity
- 7) Teratogenicity
- 8) TLV-TWA
- 9) Active Ingredient (a.i.)
- 10) ADI



Names in Group \_\_\_\_\_

Section \_\_\_\_\_

**Part II:** Turn in one report for your group. Each member of your group is responsible for all of the information in the segments. One of the group will read the report to the class. Each of you is expected to be able to answer and explain any question from the class or Dr. R. if asked to do so.

**Segment I:** Provide a short written summary of a topic assigned to your group by Dr. R. from the following possibilities: 1. *Entry and Fate of Chemicals in Humans*, 2. *Bioaccumulation*, 3. *Carcinogenesis*, 4. *Dose Response Relationships*, 5. *Ecological Effects* and 6. *Risk Assessment*. The written summary is to be no more than 1 page typed using a word processor that is to be turned in to Dr. R.. The write-up can be in outline form. Information on these topics can be found on the Web site: <http://extoxnet.orst.edu/> under *Toxicology Information Briefs*.

**Segment 2:** This exercise involves information that was actually developed for an academic institution by the **IT Corporation**. It has been modified for this exercise. The data are air sampling results for 4 common organic solvents: acetone, ethyl acetate, methylene chloride and toluene, which are included in TABLE 1. You are to answer the following questions from information found in the MSDS for each compound. The MSDS information can be located by using various databases located on the Web. See:

<http://www.ilpi.com/msds/index.html#Internet>  
(Use a grade of 95% purity or higher.)

1. What are OSHA's PEL time weighted average exposure limits for the materials?

Acetone \_\_\_\_\_ Ethyl acetate \_\_\_\_\_

Methylene Chloride \_\_\_\_\_ Toluene \_\_\_\_\_

2. Write the sample number(s) in the **IT** report for those that are equal to or above the allowable OSHA PEL limits.

Acetone \_\_\_\_\_ Ethyl acetate \_\_\_\_\_

Methylene Chloride \_\_\_\_\_ Toluene \_\_\_\_\_

**Acetone:**

3. What are the NFPA ratings for acetone?

Health \_\_\_\_ Flammability \_\_\_\_ Reactivity \_\_\_\_ Contact \_\_\_\_

4. What is the color storage code for acetone and what does it signify?

5. What should be done if acetone is splashed into your eyes?

6. What can be used to fight an acetone fire?

**Ethyl acetate:**

7. What are the NFPA ratings for ethyl acetate?

Health \_\_\_\_ Flammability \_\_\_\_ Reactivity \_\_\_\_ Contact \_\_\_\_

8. What can be used to fight an ethyl acetate fire?

9. List three materials that react violently with ethyl acetate and should be avoided.

10. What are the possible effects of chronic overexposure to ethyl acetate?

**Methylene chloride:** (dichloromethane)

11. What are the NFPA ratings for methylene chloride?

Health \_\_\_\_ Flammability \_\_\_\_ Reactivity \_\_\_\_ Contact \_\_\_\_

12. Is methylene chloride thought to cause cancer in humans? Briefly explain your answer.

13. How would you dispose of 100 mL of methylene chloride? What are the government regulations governing disposal of this chemical?

14. Should a pregnant student consider methylene chloride exposure a high health risk? Briefly explain your answer.

**Toluene:**

15. What are the NFPA ratings for methylene chloride?

Health \_\_\_\_ Flammability \_\_\_\_ Reactivity \_\_\_\_ Contact \_\_\_\_

16. How would you clean up a small spill of toluene?

17. What is the reported odor of toluene?

18. Is it OK to use water to put out a toluene fire? Why or why not?

19. What is methylene chloride's LD<sub>50</sub>-oral-rat? How much methylene chloride would the heaviest member of your group need to ingest to be equivalent to this amount in a human? (Show your calculation.)

20. Rank the 4 chemicals in what you think their order of increasing health & safety risk would be in common laboratory use in Chem 226. Briefly cite the criteria used in your appraisal.

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Appraisal criteria:

TABLE 1

SOLVENT VAPOR AIR SAMPLING RESULTS  
 PHYSICAL SCIENCES: Organic Laboratory  
 Wattsamatta U.  
 MARCH 9, 2002

| Sample No. | Location                   | Time ON | Time OFF | Flow Rate (Lpm) | Vol. (L) | Analyte            | Conc. (ppm) TWA |
|------------|----------------------------|---------|----------|-----------------|----------|--------------------|-----------------|
| S-1        | Directly across from hood  | 08:33   | 11:53    | 0.050           | 10.1     | acetone            | 1000.0          |
|            |                            |         |          |                 |          | ethyl acetate      | ND(<1.0)        |
|            |                            |         |          |                 |          | methylene chloride | 600.0           |
|            |                            |         |          |                 |          | toluene            | ND(<0.47)       |
| S-2        | Work-station next to hood  | 08:37   | 11:57    | 0.055           | 11.0     | acetone            | ND(<1.5)        |
|            |                            |         |          |                 |          | ethyl acetate      | 515.0           |
|            |                            |         |          |                 |          | methylene chloride | ND(<0.71)       |
|            |                            |         |          |                 |          | toluene            | 8.5             |
| S-3        | S-1 site with open bottles | 11:54   | 15:14    | 0.050           | 10.1     | acetone            | 685.0           |
|            |                            |         |          |                 |          | ethyl acetate      | 450.0           |
|            |                            |         |          |                 |          | methylene chloride | ND(<0.77)       |
|            |                            |         |          |                 |          | toluene            | 550.0           |
| S-4        | S-2 site with open bottles | 11:59   | 15:19    | 0.055           | 11.0     | acetone            | 250.0           |
|            |                            |         |          |                 |          | ethyl acetate      | 450.0           |
|            |                            |         |          |                 |          | methylene chloride | 155             |
|            |                            |         |          |                 |          | toluene            | ND(<0.43)       |

All samples analyzed by gas chromatography

Lpm • Liters per minute

L • Liters

ppm • parts per million by volume

ND • none detected at detection limit stated

TWA • Time Weighted Average